

Comparison of Simultaneous Prompting and Constant Time Delay Procedures in Teaching Children with Autism the Responses to Questions about Personal Information

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Abstract

The aim of the current study was to compare simultaneous prompting (SP) and constant time delay (CTD) in terms of their effectiveness and efficiency in teaching children with autism how to respond to questions about personal information. The adapted alternating treatments model was used in the study. Three male students with autism aged 4, 6, and 9, respectively, were included in the study. The findings of the study did not indicate any significant difference in two students with respect to the effectiveness of SP and CTD procedures. On the other hand, SP was observed to create more positive results and lead to a higher level of learning for the third participant. According to the findings, SP was more effective for one participant with respect to all the parameters studied. While SP was more efficient in the other two subjects in terms of incorrect responses, the difference regarding the instructional time to criterion for these two subjects was at a minimal level in favor of SP.

Keywords: Autism spectrum disorder • Errorless teaching • Simultaneous prompting • Constant time delay

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Despite the fact that scientific studies on the autism spectrum disorder (ASD) have been conducted for half a century, there are still various topics that have not yet been explained. A huge variety of researchers from diverse fields such as medicine, psychology, and education have studied ASD. As a result of these studies, individuals that are diagnosed with ASD have been provided with various services with diverse characteristics. However, many of the studies conducted in this field unfortunately lack a scientific basis (Kurt, 2012a). This has created the need to identify procedures that are proven through experimental studies in terms of their effectiveness. With the aim of determining effective procedures used in the field of ASD, experimental studies published in this field have been analyzed and the results of research compilation studies have been published (National Autism Center [NAC], 2009; Wong et al., 2013).

One of the procedures that has been proven in terms of its effectiveness through various studies, and identified to be evidence-based in research compilation study reports, is prompting (Odom, Collet-Klingenbergs, Rogers, & Hatton, 2010; Wong et al., 2013). The CTD and SP are listed among the effective procedures that are frequently used in teaching various skills to the individuals with ASD and developmental disabilities with the aim of presenting them prompts in a systematic way.

The CTD is a teaching procedure that consists of two phases, which are 0-second delay trials and constant delay trials. In the first phase of this teaching procedure, there are sessions where 0-second delay trials are performed. In these sessions, a target stimulus and controlling prompt are presented simultaneously. Following the 0-second delay procedure that is performed as many times as planned, the controlling prompt is presented upon waiting for a certain period following the target stimulus. A delay period is presented in order to provide the child with the opportunity to respond to the target stimuli independently (Browder & Snell, 2000; Kurt, 2009; Tekin-İftar, Kurt, & Çetin, 2011). There are two types of time delay teaching procedures: constant time delay (CTD) and progressive time delay (PTD). In the constant time delay procedure, a constant time period (i.e. 4 seconds) of wait is allowed for the individual to respond after the target stimulus is presented. In the progressive time delay procedure, the delay period is progressively increased. For instance, a 2 second time delay is allowed at the beginning after the target stimulus is presented, which is followed by 4 and 6 seconds of delay periods, respectively,

in order to present the prompt (Kurt, 2102a; Tekin, 1999; Wolery, Bailey, & Sugai, 1988).

There are various studies that have indicated the effectiveness of the CTD procedure in teaching the individuals from various age and disability groups including individuals with autism. Learning the names of capital cities (Head, Collins, Schuster, & Ault, 2011), learning the names of animals and clothes (Tekin-İftar et al., 2011), reading words (Gast, Ault, Wolery, Doyle, & Belanger, 1988), and recognizing informative boards (Yıldırım & Tekin-İftar, 2002) could be listed as examples for discrete skills that could be taught through the CTD procedure. Aquatic play skills (Yılmaz, Birkan, Konukman, & Erkan, 2005), preparing food and drinks (Bozkurt & Gursel, 2005), shopping skills (Dippi-Hoy & Jitendra, 2004), and free-time skills (Kurt & Tekin-İftar, 2008) could be listed as examples for chained skills that could be taught through constant time delay procedures.

Within the SP, which comes next after CTD in the literature, the controlling prompt is presented immediately after the target stimulus. Since the controlling prompt is presented in every trial, individuals are not allowed to respond independently within the SP procedure. Therefore, whether the stimulus control transfer could shift from the controlling prompt towards the discriminative stimulus could be understood through the probe sessions (Kurt, 2009; Morse & Schuster, 2004; Tekin-İftar & Kircaali-İftar, 2013).

SP has been observed to be effective in teaching discrete skills such as pointing the numerals (Akmanoglu & Batu, 2004), learning the names of the relatives (Akmanoglu-Uludağ & Batu, 2005), and reading words (Gibson & Schuster, 1992), as well as chained skills such as preparing fruit juice from fruit concentrates (Schuster & Griffen, 1993), locking and unlocking closets (Fetko, Schuster, Harley, & Collins, 1999), leisure skills (Kurt & Tekin-İftar, 2008), and hand washing (Parrot, Schuster, Collins, & Gassaway, 2000).

As mentioned before, since it was introduced to the literature in terms of teaching individuals with developmental disabilities, many studies have been published indicating the effectiveness of CTD (Dogoe & Banda, 2009; Walker, 2008). Notwithstanding that SP is a more recent type of procedure than CTD, it is also a teaching procedure for which there has been an increasing level of research support in terms of its effectiveness for the last 20 years (Morse & Schuster, 2004; Waugh, Alberto, & Fredrick, 2011). In short, both teaching procedures could be used effectively in

teaching individuals with developmental disabilities. However, the fact that a teaching procedure is effective, or in other words, a teaching procedure could conclude as planned is an essential condition in order to decide to use the said method, but it is not sufficient by itself. In addition to the effectiveness of the teaching method to be used, its efficiency should also be questioned. In defining the effectiveness of teaching, Wolery, Ault, and Doyle (1992) mentioned that an effective method could be more efficient when it requires less energy and time, and concludes with better learning as well. It was reported that better learning could be assessed through learning quickly, a higher level of generalization, more comprehensive learning, establishing a relationship between what has and has not been taught, as well as positive impacts on future learning (Tekin-İftar & Kircaali-İftar, 2013; Wolery et al., 1992). One of the methods that could be used in determining the efficiency of a teaching procedure is comparative analysis. Using comparative analysis, it could be identified which one of the two procedures (at least) is easier and more economic, which one leads to conclusions in a shorter time and which one results in fewer incorrect student responses (Head et al., 2011; Tekin-İftar, 2012a).

Until today, five studies, which compared SP and CTD in terms of their effectiveness and efficiency, have been published. Schuster, Griffen, and Wolery (1992) compared CTD and SP in terms of their effectiveness and efficiency in teaching sight words to four 10- to 11-yearold students with moderate mental retardation. The study concluded that both teaching procedures were effective. When teaching procedures were compared in terms of efficiency, the findings were in favor of SP with a slight difference. In the study, SP was observed to be more efficient compared to CTD in terms of the training time to criterion, total number of training sessions, and the number of incorrect responses. It was reported that the data on the comparison of maintenance effects of both teaching procedures were rather complex. The maintenance findings were in favor of SP for two of the four students, while they were in favor of CTD in the other two students. Tekin-İftar and Kircaali-İftar (2002) analyzed whether SP and CTD differed in terms of efficiency and effectiveness in teaching the names of animals to the children with mild to moderate mental retardation, and who were aged between 7 and 10 years. The study concluded that both procedures were equally effective. The findings regarding efficiency showed that the difference between the two teaching procedures was at a minimal level; however, SP was identified to have been more efficient than CTD in terms of the

numbers of errors that occurred until the criteria were met as well as the total training time. With respect to the maintenance findings, no difference was observed; however, it was reported that CTD resulted in a higher level of generalization. Riesen, McDonnell, Johnson, Polychronis, and Jameson (2003) compared the effectiveness of SP and CTD in teaching discrete academic skills. Four students with moderate to severe disabilities, who were aged between 13 and 14, participated in the study. According to the results of the study, both methods are effective in acquisition of the target behaviors. CTD was more effective in two of the four subjects, while SP was more effective in the other two subjects. In another study, where the two procedures were compared in terms of effectiveness and efficiency (Kurt & Tekin-İftar, 2008), four children with autism, who were aged between 6 and 8, were taught how to turn on a CD player and take photos using a digital camera. Both teaching procedures were effective. There was no significant difference between the efficiency findings of the study. In two of the subjects, CTD was more effective while SP was more effective for the other two subjects. In the latest publication that aimed to compare SP and CTD (Head et al., 2011), four high school students with learning disabilities and behavioral disorders, who were aged between 16 and 18, were taught the capital cities of the states in the United States of America. It was concluded that both teaching procedures were effective and SP was found to be slightly more efficient than CTD with respect to the number of incorrect responses of the students. Furthermore, the findings of the study at the maintenance phase were in favor of SP at the minimal level.

The number of studies that compared SP and CTD in terms of effectiveness and efficiency is quite limited. Findings of these studies have shown that both teaching procedures were generally effective; however, findings regarding efficiency were rather complex and lacked clear conclusions. In studies, where a difference was found between the two teaching procedures, it has been indicated that the difference was minimal. Findings obtained through the data collected from the limited number of studies comparing the two teaching procedures could not be deemed sufficient for generalization. All the studies that compared SP and CTD were conducted using the single-subject research designs in which external validity is quite essential (Gast, 2010; Head et al., 2011; Tekin-İftar, 2012b). In order for a single-subject research design to establish the scientific basis for a procedure, the findings of that study must be repeated in different studies, by different trainers, and with different

participants (Horner et al., 2005; Kircaali-İftar, 2012; Odom et al., 2010). Recent studies, in which these two teaching procedures have been compared, are recommended to be repeated with different participants, under different conditions, for the purpose of teaching different skills (Head et al., 2011; Kurt & Tekin-İftar, 2008). In light of this, the current study aimed to compare SP and CTD in terms of their effectiveness and efficiency in teaching children with autism the responses to the questions on their personal information by expanding on the findings obtained thus far. According to this aim, answers were sought to the following questions: (a) Do SP and CTD differ in terms of their effectiveness and efficiency in teaching children with autism the responses to questions about personal information at the acquisition, maintenance, and generalization phases? (b) Do the two teaching procedures differ in terms of the number of sessions, number of trials, total training time, and percentage of errors until the criterion is met? (c) What are the opinions of the parents of the participants with autism about the study?

Method

Participants

Subjects: The participants of the study were three male students aged 4, 6, and 9, respectively, who were all diagnosed with ASD. Through the interviews conducted with their parents, it was found that the subjects were diagnosed in medical institutions. Two participant students were attending general education schools during the study. One of these students was enrolled in elementary school and the second one was enrolled in kindergarten; they were both receiving one-to-one training support from a developmental disability unit at a university. The third participant of the study was benefitting from the special education services in group settings three hours per day on weekdays at the same developmental disability unit at the university. All subjects had received systematic teaching, whereas only one of them (Faruk) was taught systematically through SP and CTD. The skills that were aimed to be taught in this study were selected among those that were included in the individualized education programs of the participating students. In order for the subjects to participate in the study, written consent was obtained from their parents.

The prerequisite features that the subjects were expected to have in this study were audial perception, being able to follow verbal instructions, being able to repeat sentences with two or three

words, and being able to attend the teaching activity for five minutes. In order to identify whether the subjects had the skills for audial perception and the ability to follow verbal instructions, they were given various verbal instructions such as "Come here," "Show me the red one," "Give the eraser to Mr. Ali," and the subject was observed to determine whether s/he could respond to these instructions correctly. In order to determine whether the subjects could repeat the statements with two or three words, they were given statements with two or three words during the story reading activity and the subjects were expected to repeat them. During the observed sessions, the subjects were identified to have audial perception skills, as well as the ability to follow verbal instructions. With the aim of determining whether the subjects could maintain their concentration on a teaching activity for five minutes, one-to-one teaching activities, which were performed as a part of the programs that the students were already enrolled in, were observed and the subjects were found to qualify for this prerequisite feature of the study.

Faruk is a 9-year-old male student with autism. The Leitter Intelligence Test concluded that Faruk's IQ was 49. At the time of the study, Faruk was enrolled in the first grade of a state elementary school. Furthermore, he was receiving one hour of special needs education twice a week with one-to-one training at a developmental disability unit at a university. Faruk had similar characteristics as his peers in terms of gross and fine motor skills. He was able to repeat statements with two or three words and made use of these statements where it was necessary to continue his communication. He was able to respond to questions with two or three words (i.e. "Where shall we go now?"¹, "Who came?") using simple sentences and start a conversation with his friends with the aim of asking for an object. Faruk was able to concentrate on an activity for approximately 15 minutes and knew how to read and write. He experienced certain difficulties regarding social skills and communication skills. He needed to be taught certain skills related to social interaction and communication. Faruk was not able to respond to many questions about himself.

Utku is a 4-year-old male student with autism. He was enrolled in a state kindergarten and he was receiving one hour of special needs education twice a week with one-to-one training implementation. The Leitter Intelligence Test concluded that Utku's

¹ [T.N. The Turkish version of this question has three words]

IQ was 80. Utku had similar characteristics with his peers in terms of gross and fine motor skills. He was able to draw pictures using crayons while coloring outside the lines, and he was able to eat by himself. Utku was able to concentrate on an activity for approximately 10 minutes. He knew colors and geometric shapes. He used sentences with two or three words in order to start and continue a conversation. He needed to be taught certain skills related to social interaction and communication. Utku experienced certain difficulties in social and communication skills. He was mostly unable to respond to questions about himself.

Ozan is a 6-year-old male student with autism. At the time of the study, Ozan was receiving three hours training every day in the week in a self-contained classroom at a developmental disability unit of a university. No score is available for his level of cognitive ability. He had similar characteristics with his peers in terms of gross and fine motor skills. Ozan was able to concentrate on an activity for approximately 5 minutes and could recite the names of the shapes, colors, and objects for which he was prompted. He was able to repeat certain statements with one or two words and could initiate communication by using usually a single word in order to express his needs. He was able to follow the simple instructions. Ozan experienced certain difficulties regarding social skills and communication skills. He needed to be taught about certain skills related to social interaction and communication. Ozan was usually not able to respond to many questions about himself.

Staff: In the study, two trainers, who worked at a university as a research assistant and instructor respectively, carried out all sessions. While one of the trainers continued his/her PhD in the field of special education, the other one had a graduate degree in special education. One of the trainers studied theoretical and practical education about SP and CTD during his graduate degree, while the other one studied them in both his/her graduate and postgraduate training. Therefore, both trainers had knowledge and experience about the application of SP and CTD.

Peers: In this study, with the aim of obtaining data to determine whether the subjects were able to generalize the target behaviors across social environments and their peers with normal development, probe sessions were conducted. In these probe sessions, questions on the personal information of the subjects were asked by two peers. The peers, who participated in the study, were two

female students with normal development at the ages of 8 and 10 respectively, who were enrolled in the third and fourth grades of elementary school. Before the generalization sessions peers were informed about the study. During this informative study, the aim of the study was explained to the peers and they were acknowledged about the questions on personal information that they were expected to ask. At this phase, the researchers explained what the term "personal information" meant and provided examples of relevant questions. Later on, the trainers showed peers how to behave while asking the questions by pretending to be the learners in order to enable the peers to practice. Subjects and peers were introduced to each other before the generalization sessions.

Settings and Materials

Except for the generalization sessions, all sessions with Faruk were conducted in the study room of the first author in his own house. Sessions with Utku were conducted in one of the one-to-one studying rooms in the unit where he was enrolled. Ozan's sessions were performed in his classroom. In the study, while teaching the responses to the questions about personal information, a digital audio recording device was used with the aim of presenting the controlling prompt. All sessions were video recorded for data collection.

Dependent and Independent Variables

The dependent variable of this study was the percentage of the correct answers given by the subjects to the questions about their personal information. Two training sets were prepared for all the participants regarding their personal information. In order to determine the questions, the answers of which were targeted to be taught, parents of the subjects were given a list of 30 items and they were expected to choose at least 20 questions that they would like their children to be taught. Parents were informed that they could add to the list in case there were other questions that they would have liked their children to learn. Later on, two training sets, each of which contained ten questions out of the 20 questions identified by the parents, were created for all the subjects. One of these training sets was taught through the SP, while the other one was taught through the CTD. Training sets for each subject and for each teaching procedure were identified randomly. The instructional procedures used to teach the target

Table 1
Subjects, Teaching Procedures, and Target Responses

Subjects	Teaching Procedures	
	Simultaneous Prompting Procedure	Constant Time Delay Procedure
Faruk	1. Could you tell me your father's cellphone number? 0583 353 43 63 2. Do you have a grandmother? Yes. 3. What is the name of your grandmother (paternal)? Emine Ertan. 4. Do you have a brother or sister? No. 5. What is your home phone number? 329 17 66 6. What is your favorite drink? Soda. 7. What is your favorite dish? French fries and meat balls 8. Where do you live? Eskişehir 9. What grade are you in? I'm in the first grade. 10. What is your address? Near the Thursday's marketplace.	1. What are the names of your friends at school? Bahri-Arda-Ayça-Atakan 2. Do you have a grandmother? Yes. 3. What is the name of your grandmother (maternal)? Mürvet Beyazlar 4. Do you have any pets? No. 5. Could you tell me your date of birth? June 19, 1997 6. How old are you? 9 7. What do you like doing most? Using the Internet 8. What does your father do? Site Chief 9. What is the name of your teacher? Canan Kaşik 10. Could you tell me your address? Aliağa Mah. Karaçay Sok. No:17.
	1. What do you like doing most? Watching TV 2. What is your favorite toy? Cars 3. What is your favorite animal? Dog 4. Do you have a brother or sister? No 5. What is the name of your grandmother (paternal)? Emine Yeşil 6. What is your favorite drink? Milk 7. Could you tell me your mother's cellphone number? 0529 704 93 20 8. When is your birthday? 19 th March 2003 9. What is your address? Çarşı Mah. 10. What does your father do? Worker	1. What is your favorite game? Riding a bike 2. What don't you like doing? Painting 3. What is your favorite dish? Meatballs 4. Do you have a pet at home? No. 5. What is the name of your teacher? Fadime Öztürk 6. Where do you like going? Park 7. What are the names of your friends at school? Erdem-Sergen-Melike-Melisa 8. What is your home phone number? 319 58 73 9. What does your mother do? Housewife 10. How many people are there in your family? Three people.
	1. When is your birthday? November 7, 2001 2. What is your favorite soccer team? Fenerbahçe 3. How many people are there in your family? 5 4. What does your mother do? Housewife 5. What do you like doing most? Riding my bike 6. What is your father's business phone number? 138 28 78 7. Do you have a grandmother (maternal)? Yes 8. What is the name of your grandmother? Döndü Taşmaz 9. What floor is your apartment on? 2 10. Which animals does your grandmother (parental) raise? Sheep, Chicken	1. Could you tell me your address? Can Mah. Er Sok. No:8 2. Where do you live? In Eskişehir 3. How old are you? 5 4. What does your father do? Officer 5. What is your favorite dish? French Fries and Meatballs 6. What is your home phone number? 133 73 33 7. Do you have any sisters? Yes 8. How many sisters do you have? Two 9. Where do you like going? Going to the village 10. How much do you weigh? 20
Ozcan		

responses for each participant are presented in Table 1. Due to ethical reasons, some of the answers about students' private information were changed in Table 1.

The independent variables of the study were SP and CTD. In comparing the two teaching procedures in terms of their effectiveness, correct and incorrect responses of the subjects were recorded. In order to identify whether the teaching procedures differed in terms of efficiency, data were collected in terms of the number of trials and sessions to criterion, the number and percentage of incorrect responses during probes and training sessions, and instructional time to criterion.

Experimental Design

The adapted alternating treatments design, as one of the single-subject research designs, was used to compare the SP and CTD in the study. The adapted alternating treatments design is a research model in which the effectiveness of two or more independent variables on two or more nonreversible dependent

variables is compared (Kurt, 2012b; Sindelar, Rosenberg, & Wilson, 1985). In the adapted alternating treatments design, the experimental control is established when the change in the level and trend of a dependent variable that is related to an independent variable occurs faster than the other dependent variables related to the independent variable(s). In addition, the level and trend in the data from baseline conditions to training conditions are compared (Kurt, 2012b; Sindelar et al., 1985; Wolery et al., 1988). In this study, in order to address the requirements of the adapted alternating treatments design, attention has been paid to the following points: training sets included in the dependent variables were created through difficulty level analysis. During the difficulty level analysis, the length of the questions and responses were taken into account, as well as the way they were spelled. Training sets, which were believed to have equal difficulty levels, were matched with independent variables and two training sets were created for each subject. There were ten personal information questions and responses in each training set. Subjects were taught

one of the training sets through SP and the other one through CTD. Training sets were assigned to teaching procedures randomly. Rapid alternations of the teaching procedures were ensured. This alternation was ensured through implementing the two teaching procedures at different hours within a single day. However, special attention was paid to the implementation of each teaching procedure at one-hour intervals. Both teaching procedures were administered in an equal number of sessions. Independent variables, or in other words, all variables except for the variables that were unique to teaching procedures were distributed equally. In order to achieve this, similar reinforcers and reinforcement schedules were used during both teaching procedures.

Experimental Procedure

Probe Sessions: In the study, in order to teach how to respond to the personal information questions, SP and CTD were presented. Since the subject was not allowed to respond independently within SP, teaching data regarding the skills that were taught through this teaching procedure were tested during the probe sessions. Therefore, two types of probe sessions were organized in the study, as baseline probe sessions and daily probe sessions. Within baseline probe sessions, the aim was to determine the performance levels of the subjects regarding the dependent variables prior to teaching. During the comparison of the two teaching procedures in terms of their effectiveness, data obtained from the daily probe sessions were used. Because students do not have the opportunity to respond to the questions independently in SP, daily probe sessions were needed to standardize the condition across CTD and SP for testing acquisition.

Baseline Sessions: Baseline sessions were held twice on weekdays for two of the subjects and once a day during four days a week for the other subject with respect to each training set. During all probe sessions, correct responses were reinforced using social reinforcements by using the continuous reinforcement schedule. Probe sessions were held as follows: First, the trainer presented a prompt in order to attract the attention of the subject (i.e. "Faruk, are you ready to study?"). When the subject displayed behaviors showing that s/he is ready to study (i.e., when he makes eye contact with the trainer and waits for the study to start), this was reinforced by the trainer and the target stimulus was presented (i.e., "Very good! Where do you live?"). Next, the trainer waited for the subject's

response for a period of four seconds. In case the subject responded to the target stimuli correctly within four seconds, this was reinforced with social reinforcements (i.e., "Well done! Very good!"). Incorrect responses were ignored during the probe sessions and the next question was asked.

Daily Probe Sessions: Daily probe sessions were conducted with the aim of determining performance levels of the subjects with respect to the questions being taught through both teaching procedures. Daily probe sessions were conducted right before the session that followed the training session. In the daily probe sessions, the same procedure followed in the baseline probe sessions was used.

Training Sessions: Upon collection of stable data from baseline sessions, the training sessions started. Both teaching procedures were applied to the two subjects twice a week and the third subject four times a week in the form of one training session per day. In both teaching procedures, each target stimulus included in the training sets was presented twice; in other words, 20 trials were performed in each training session. Training sessions continued until the subjects were able to respond 100% accurately in three consequent sessions during daily probe sessions. Verbal prompting, which represented the controlling prompt in training sessions, was presented through the audio recording device. The reason why the trainers made use of the audio recording device as the controlling prompt was to prevent the subjects with autism from speaking echolalia. Therefore, the trainers preferred to use the audio recording device instead of spelling the verbal prompt, which is the controlling prompt. Correct responses given in the training sessions were reinforced through continuous reinforcement until the criteria were met without considering whether they were presented before or after the prompt. Attentive and cooperative participation of the subjects in the study were reinforced through social reinforcement. Incorrect responses of the subject were corrected. The trainer interfered in order to stop the incorrect response of the subject and ensured that the subject responded correctly through presenting the controlling prompt together with the target stimulus. After the specified criteria were achieved in the study only the final correct response was reinforced. Special attention was paid to allow at least a one-hour of delay between the training sessions where independent variables were applied.

Simultaneous Prompting: Prior to starting the SP sessions, subjects were presented prompts by the trainer in order to attract their attention (i.e., "Ozan, are you ready?"). After the subject

concentrated in the study, the trainer reinforced the subject verbally (i.e. "Yes! Well done!") and presented the target stimulus (i.e. "What is your favorite soccer team?"). In each training session, 0 second time delay trials were performed. In other words, the trainer presented the controlling prompt with the help of the audio recording device without allowing the subject to respond independently (i.e. "Galatasaray") and ensured that the subject imitated the correct response.

Constant Time Delay: CTD sessions started by ensuring the concentration of the subject in the study. In order to achieve that, the subject was presented with a prompt ("i.e. "Utku, shall we study a little?"). If the subject expressed that he was ready to study, he was reinforced (i.e. "Good! Let's start") and the target stimulus were presented (i.e. "What is the name of your teacher?"). In the first training session, 0 second time delay trials were performed. In order to achieve that, in the first training session, the trainer presented the target stimulus initially and then presented the controlling prompt with the help of the audio recording device in the form of verbal prompt. In other words, in the first session of CTD, the same procedure as in SP was followed. In the next training sessions, the delay period was increased to 4 seconds and all trials were administered as 4 seconds. With this aim, the trainer presented the instruction, waited for the 4-second constant time delay and presented the controlling prompt in the form of verbal prompt.

Maintenance and Generalization

At the maintenance and generalization phases reinforcements were presented by using fixed ratio reinforcement schedule. In other words, reinforcements were presented after a total of ten correct responses (FR10). Except for the reinforcement schedule, the same procedure as in probe sessions was followed in these sessions. While maintenance and generalization data were collected from Faruk and Utku, because of summer break, the study was terminated with Ozan. The study was not conducted with Ozan until the criteria were met; therefore, maintenance and generalization data regarding Ozan could not be collected.

Maintenance sessions were held after one, two, and four weeks after the criteria were met. Generalization across people and settings was measured in the study with pre-test and post-test designs. In these sessions, an adult in the cafeteria of the unit at which the subjects were enrolled asked personal questions. The sessions that were conducted with the aim of

maintenance of generalization were held 4 months after the criteria were met for Faruk and 5 months after the criteria were met for Utku. In these probe sessions, peers with normal development asked personal questions to the subjects in a park and fast-food restaurant, which are common social spaces.

Reliability

In at least 20% of all sessions conducted during the study, data were collected regarding inter-observer reliability and procedural reliability. A postgraduate student, who was studying special needs education, collected the reliability data of the study. With respect to the analysis of the data regarding the inter-observer reliability, the $[(\text{Agreement}/\text{Agreement} + \text{Disagreement}) \times 100]$ formula was used (Tawney & Gast, 1984; Tekin-İftar & Kircaali-İftar, 2013). The inter-observer reliability coefficient was calculated as 98.8%. The lowest inter-observer reliability coefficient was 95% while the highest inter-observer reliability coefficient was calculated as 100%.

In collecting data regarding the procedural reliability, the following behaviors of the trainers were taken into account: (i) preparing materials, (ii) ensuring attention, (iii) presenting the target stimulus, and (iv) reacting appropriately and accurately towards subject responses. In the SP sessions, the following behaviors of the trainers were taken into account: (i) preparing materials, (ii) ensuring attention, (iii) presenting the target stimulus, (iv) presenting the controlling prompt accurately, and (v) reacting appropriately and accurately towards subject responses. In the CTD Sessions, following behaviors of the trainers were taken into account: (i) preparing materials, (ii) ensuring attention, (iii) presenting the target stimulus, (iv) allowing appropriate time delay (0 sec or 4 sec), (v) presenting the controlling prompt accurately, and (vi) reacting appropriately and accurately towards subject responses. Procedural reliability was calculated by dividing number of trainer behaviors observed by number of trainer behaviors planned multiplied by 100 (Billingsley, White, & Munson, 1980; Tekin-İftar & Kircaali-İftar, 2013). All sessions of the trainers were determined to have been performed at 100% reliability in the study.

Social Validity

In order to determine the importance of the aims of this study, as well as the teaching procedures used for achieving these aims and the results of the study, the social validity data were collected. The social validity

data were collected through the subjective evaluation by obtaining the opinions of the parents (Kurt, 2012c). In order to improve the social validity of the study, the target behaviors taught in the study were identified in light of the expressed parent opinions. The social validity data were collected through the "Social Validity Inquiry Form," which was developed by the researchers. In the first part of the Social Validity Inquiry Form, there was a short explanation about how the data collection tool should be completed; while the second part contained a total of 12 questions to determine the parent opinions about the study. Ten of the questions were closed-ended and two of them were open-ended, short-answer questions. Answers to the close-ended questions were "yes" and "no."

Findings

Effectiveness and Efficiency

Data regarding the effects of SP and CTD on teaching Faruk, Utku and Ozan how to respond to personal questions are displayed in Figure 1, Figure 2, and Figure 3, respectively. In order to test whether SP and CTD differed in terms of their efficiency, data collected regarding (a) the number of sessions, (b) the number of trials, (c) the number of incorrect responses, and (d) instructional time until the criteria were met are displayed in Table 2.

Data presented in Figure 1 regarding the personal questions that were aimed to be taught to Faruk were analyzed and it was found that Faruk was able to perform at an 8.3% (range = 5% - 10%) mean accuracy level in the first three baseline sessions with respect to the training set that was taught through SP. Faruk responded to the training set that was taught through CTD at the 8.3% (range = 5% - 15%) accuracy level during the baseline probe sessions. At the training phase, where both teaching procedures were implemented, Faruk responded to the personal questions with 100% accuracy. In order for Faruk to learn the responses to the personal questions, which were aimed to be taught through SP and CTD, nine training sessions and 180 training trials were performed. Data regarding the number of incorrect responses were analyzed and the results revealed that the daily probe sessions for the training set that was taught through SP, Faruk responded incorrectly 36 times (22.5%), while he responded in daily probe sessions for the training set that was taught through CTD 55 times (34.3%) incorrectly. Until the criteria were met, SP was observed to have lasted for 47 minutes and 13 seconds; CTD was found to have lasted 1 hour, 14 minutes and 2 seconds.

Data presented in Figure 2 regarding the personal questions that were aimed to teach Utku were analyzed and it was found that Utku was able to perform at a 6.6% (range = 5% - 20%) mean accuracy level in the first three baseline sessions with respect to the training set that was taught through SP. Utku responded to the training set that was taught through CTD at a 1.6% (range = 0% - 5%) accuracy level during the baseline probe sessions. At the training phase, where both teaching procedures were implemented, Utku responded to the personal questions with 100% accuracy. In order for Utku to learn the responses to the personal question, which were aimed to be taught through SP, ten training sessions and 200 training trials were performed, and 15 training sessions and 300 training trials were performed in order for him to learn the responses to the personal questions, which were aimed to be taught through CTD. Data regarding the number of incorrect responses were analyzed and in the daily probe sessions for the training set that was taught through SP, Utku responded incorrectly 30 times (16.6%), while he responded in daily probe sessions for the training set that was taught through CTD 55 times (19.6%) incorrectly. Until the criteria were met, SP was observed to have lasted for 47 minutes and 13 seconds; CTD was found to have lasted 1 hour, 14 minutes and 2 seconds.

Data regarding the personal information questions that Ozan was aimed to be taught are displayed in Figure 3 and it was found that Ozan performed accurately during the first three baseline sessions at a level of 5% for the training set that was taught through SP, while performing at a 1.6% (range = 0% - 5%) accuracy level regarding the training set that was taught through CTD. At the training phase, stable data were obtained regarding the training set in which SP was implemented, with accuracy response percentage of 90%; in other words, learning occurred at a very close level to the criteria. Despite the fact that a certain level of learning ($\bar{x} = 53.9\%$; range = 20%-65%) occurred in Ozan with respect to the training set in which CTD was implemented, the study was discontinued due to the end of the semester and summer break. According to the findings, 15 training sessions and 300 training trials were performed with Ozan regarding the training set, in which SP was implemented. On the other hand, as a result of 15 CTD sessions, Ozan was unable to respond to the questions at a certain level of accuracy that met the criteria. Due to the end of the semester, the study was not continued within this training set. Data regarding the number of incorrect responses

Table 2
Efficiency Data

Students	Interventions	# of instructional sessions	# of instructional trials	#-% of errors through criterion	Instructional time (h:min:s)
Faruk	CTD	9	180	36 - 22.5%	00:47:35
	SP	9	180	55 - 34.3%	00:49:35
Utku	SP	10	200	30 - 16.6%	00:47:13
	CTD	15	300	55 - 19.6%	01:14:02
Ozan	SP	15	300	56 - 18.6%	01:28:02
	CTD	15	300	153 - 51%	01:38:28

were analyzed and it was found that in daily probe sessions for the training set that was taught through SP, Ozan responded incorrectly 56 times (18%), while he responded in the daily probe sessions for the training set that was taught through CTD 153 times (51%) incorrectly. Until Ozan was able to respond with an accuracy level of 90%, SP was observed to have lasted for 1 hour, 28 minutes, and 2 seconds; CTD was found to have lasted 1 hour, 38 minutes, and 28 seconds.

Maintenance and Generalization

Maintenance: Faruk was able to maintain the responses to the questions that were taught through SP with an accuracy level of 100% after one, two, and four weeks following the training and to the questions that were taught through CTD with an accuracy level of 96.6% (range = 90% - 100%). Maintenance sessions conducted for Utku concluded that he was able to maintain the responses to the questions that were taught through SP with an accuracy level of 88.3% (range = 80% - 95%); he was able to maintain the responses to the questions that were taught through CTD with an accuracy level of 96.6% (range = 90% - 100%). As mentioned before, no progressive data were obtained with respect to Ozan.

Generalization: Generalization data indicated that all three subjects generalized the target behaviors that were taught through SP to another setting and person at a level that was close to the criteria. When data regarding the effect of CTD on generalization were analyzed, it was found that Faruk and Utku were able to generalize the target behaviors to another setting or individual with 100% accuracy. Furthermore, maintenance sessions for generalization were held for Faruk within 4 months of the conclusion of the study and for Utku within five months. It was observed that both subjects performed with an accuracy level of 90% in both training sets. Data obtained in the study regarding generalization are presented in Table 3.

Table 3
Generalization data

Students	Interventions	Pre-Test	Post-Test	Generalization Maintenance
Faruk	SP	10	100	90
	CTD	10	100	90
Utku	SP	0	90	90
	CTD	10	100	100
Ozan	SP	0	90	-
	CTD	0	55	-

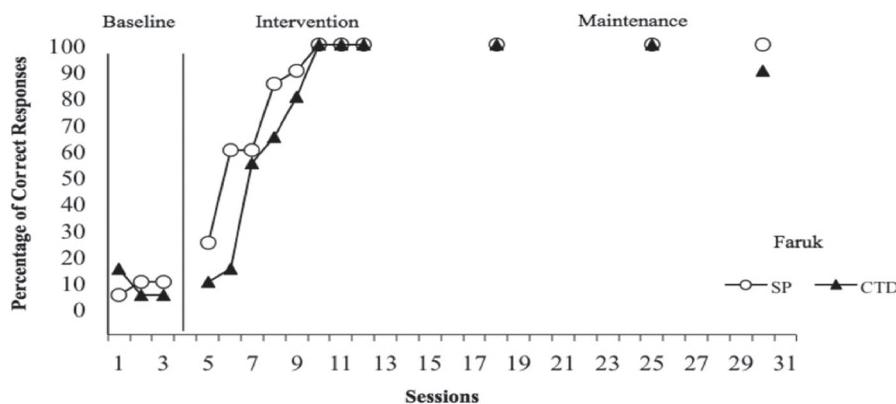


Figure 1: Percentage of correct responses for target skills by Faruk during baseline, instruction, and maintenance sessions.

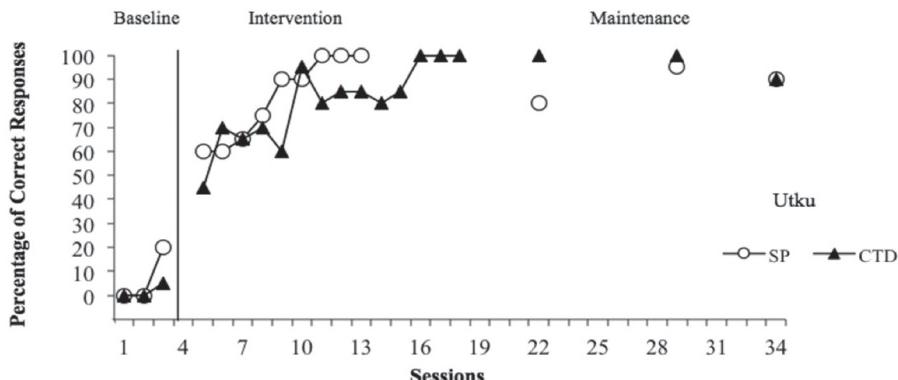


Figure 2: Percentage of correct responses for target skills by Utku during baseline, instruction, and maintenance sessions.

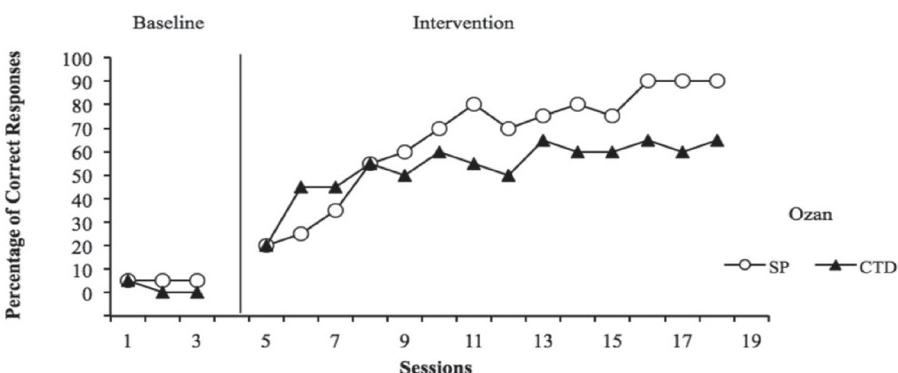


Figure 3: Percentage of correct responses for target skills by Ozan during baseline, instruction, and maintenance sessions.

Social Validity

The mothers of two subjects and father of one subject that participated in the study completed the Social Validity Inquiry Form. All parents who responded to the questions on social validity of the study expressed that they were satisfied with teaching of responding skills to their children regarding personal questions. They expressed that they thought the teaching of this skill would positively affect the social and communication skills of their children in daily life. They also expressed the need to teach their children responses to further questions in addition to the personal information that their children were taught within the study. Parents also indicated that teaching the children to respond to personal questions would also contribute to the children's life in terms of interacting with their teachers and peers within general education settings and that certain personal information taught within the scope of this study (i.e. home address, phone number, etc...) were beneficial for the safety of their children. One

mother and one father expressed their satisfaction with the teaching procedures in the teaching responses to personal questions, while one mother mentioned that she was not pleased with the utilization of audio recording device throughout the study. As a response to the question, "Could you describe the aspects of the study that you disliked or found limited with a few sentences?", one of the mothers stated that she thought it would be more appropriate to conduct this study with a greater number of participants and settings. The other mother reported that the period was too short for the study while the father who responded to the social validity form stated that there was no aspect of the study that he did not like.

Discussion

This study aimed to compare the effectiveness and efficiency of SP and CTD in teaching children with autism responses to the personal questions. In the following section, the study was discussed in light

of the findings, in terms of various dimensions, and further recommendations have been made accordingly.

The findings of this study indicated that both teaching procedures were effective on two subjects that participated in the study. The third subject was observed to respond with an accuracy level of 90% in the training set that was taught using SP. In other words, learning was achieved at a certain level close to the criteria. In this participant, despite the fact that a certain level of learning occurred with respect to the training set ($\bar{x} = 53.9\%$; range = 20%-65%), in which CTD was implemented, the criteria were not met and the study could not be continued due to the end of the semester. In short, while no significant difference was observed between SP and CTD in terms of effectiveness in two participants, it was found that SP concluded with higher level of learning in the other participant and had positive results. The effectiveness findings of this study were in line with the findings of the studies, in which SP and CTD were compared. For instance, in the study by Riesen et al. (2003), regarding the teaching of discrete academic skills to the participants with mental disabilities, SP was found to be more effective in two subjects, while CTD was found to be more effective in the other two subjects. In another study, where the two teaching procedures were compared in terms of effectiveness and efficiency with respect to teaching chained leisure skills to the participants (Kurt & Tekin-İftar, 2008), both procedures were found to be effective on three subjects, while in one subject, despite the fact that the criterion was met through SP, accurate responses at the criterion level could not be obtained through CTD.

In the study, it was found that the effectiveness of SP and CTD did not differ at the acquisition phase and there were no significant differences in the maintenance and generalization phases. In one of the two subjects, whose maintenance and generalization data were collected, monitoring data favored SP at a minimal level, while they were in favor of the CTD at a minimal level in the other subject. The generalization findings of the study showed that in one of the two subjects, from whom generalization data were collected, the generalization effects of the procedures were not to different, while in the other subject, skills that were taught through CTD were generalized at a higher level with minimal difference. Findings about maintenance and generalization were consistent with the findings of other studies, in which effectiveness of SP and CTD were compared. In previous publications where the two teaching procedures were compared, it

was observed that the effects of the treatments did not change at the maintenance and generalization phases; if there was a difference, it was at a minimum level (Head et al., 2011; Kurt & Tekin-İftar, 2008; Riesen et al., 2003; Schuster et al., 1992; Tekin-İftar & Kircaali-İftar, 2002).

In this study, the dependent variable was identified as teaching children with autism the responses to personal questions. In other studies in which SP and CTD were compared, the teaching of such a skill that could be used by children with autism within their communication processes was not compared. Therefore, when the findings of this study regarding effectiveness were interpreted together as a whole and the dependent variable of this study is considered, it could be reported that this study extended the existing literature in terms of the comparison of two procedures regarding their effectiveness.

The findings of this study regarding efficiency indicated that in one of the participants, SP was significantly more efficient in terms of all parameters analyzed in the study; while SP was again more efficient in the other two subjects in terms of the frequency of students' incorrect responses that occurred throughout the training process. Furthermore, data regarding the instructional time to criterion favored SP at a minimal level. The findings of the studies that compared SP and CTD in terms of their efficiency were analyzed, and no significant difference was found between the two procedures in terms of the efficiency variable or if there was a difference, it was at a minimal level (Head et al., 2011; Kurt & Tekin-İftar, 2008; Riesen et al., 2003; Schuster et al., 1992; Tekin-İftar & Kircaali-İftar, 2002). In this study, SP was significantly more efficient in terms of the frequency of students' incorrect responses, which was different from the findings of previous publications that compared SP and CTD. It might be thought that the difference between this study and the above mentioned studies could be related to the characteristics of the participants and the dependent variable of the study. The only study that compared the two teaching procedures with participants, all of whom were diagnosed with ASD, was conducted by Kurt and Tekin-İftar (2008). Target behaviors taught in Kurt and Tekin-İftar's study were the chained leisure skills, which was different from this study. In other words, to date, there have been no studies that compared SP and CTD in teaching discrete behaviors to participants, all of whom were diagnosed with autism. In

addition to these, learning was observed to have occurred mostly during the 0-second time delay trials; therefore, constant time delay trials, which are the parts of CTD procedure, were deemed unnecessary (Kurt & Tekin-İftar, 2008; Morse & Schuster, 2004; Tekin-İftar & Kircaali-İftar, 2002; Schuster et al., 1992). In light of this discussion and the fact that SP was significantly more efficient in terms of incorrect response frequency, it may be concluded that in sessions where the 0-second time delay trials were performed with individuals with autism, teaching discrete behaviors would result in fewer incorrect responses. In other words, in teaching discrete skills to the individuals with ASD, SP could result in fewer incorrect responses when compared to CTD. However, in order to reach such a conclusion, these findings should be repeated in other experimental studies.

The findings obtained in this study and the findings of other relevant studies, excluding a study that compared SP and CTD (Schuster et al., 1992) together, indicated that findings related to effectiveness and efficiency could change according to different participants of the same study (Head et al., 2011; Kurt & Tekin-İftar, 2008; Riesen et al., 2003; Tekiftar & Kircaali-İftar, 2002). For instance, in the study by Riesen et al. (2003), SP was more effective in two subjects, while CTD was more effective in the other two subjects. In the study by Kurt and Tekin-İftar (2008), CTD was more effective than SP in two subjects while SP was more effective in the other two subjects. Similarly, in this study, findings regarding efficiency were observed to change according to the participants. For instance, in terms of all parameters analyzed in one participant, SP was significantly more efficient; however, simultaneous prompting was observed to be more effective in another subject, only with respect to the frequency of incorrect responses. In light of the previous studies and their findings, it may be thought that the effectiveness and efficiency of SP and CTD treatments could be influenced by the individual differences of the participants. In further research, it may be important to determine whether the individual differences of subjects affected the effectiveness and efficiency of teaching procedures, which participant features would lead to differences accordingly and which procedure would lead to more positive conclusions on which of participant. Furthermore, in deciding the type of teaching procedure they would use, trainers should be recommended to consider individual differences that may affect the teaching procedures.

The main purpose of this study was to compare SP and CTD in terms of their effectiveness and efficiency in teaching children with autism responses to personal questions. However, there are certain issues that are believed to be essential, in addition to discussing the effectiveness and efficiency findings obtained from the study. These issues are discussed in the following paragraphs.

Firstly, the study conducted about the social validity of this research could be listed as one of its positive aspects. As mentioned in the explanations made in the methods section, in order to improve the social validity of this study, target behaviors taught in the study were identified according to the opinions of the parents. Collecting data regarding social validity only at the end of the study has been criticized in previous research and it has been recommended that social validity should be studied not only at the conclusion of the research, but also before and during the general procedure (Kurt, 2012c). In this study, since target behaviors were identified by the parents and the parents expressed positive opinions about the study, it is believed that the social validity of the study was rather high.

Another strength of this study was about generalization. It was observed in the study that participants, from whom generalization data were collected, could display the target behaviors that they learnt with adults and peers in other settings outside the learning environments. Sessions that were held with the aim of maintaining generalization were performed four months after the study was completed with one of the subjects and five months after completion of the study with the other subject. In these probe sessions, peers with normal development asked personal questions to the subjects in a park and fast-food restaurant, which are common social spaces. Both participants were able to continue generalizing the target behavior months after the study was completed.

Despite its positive aspects, there have been certain limitations. Firstly, the fact that the study had to be discontinued with one of the participants due to the end of the semester was one of the limitations of the study. The acquisition phase regarding the target behavior that was taught to this subject could not be completed and neither maintenance nor generalization data were collected. This hindered the interpretation of the findings related to the comparison of SP and CTD. This study was performed within the one-to-one teaching format within environments located in a special needs school, where the participating subjects were

enrolled. Therefore, there is a limitation regarding the generalization of the effectiveness and efficiency findings to general education environments. Particularly, considering the possibility that the target behaviors could contribute to the communication skills of the participants through dialogue, it may be concluded that it would be more appropriate to teach the skills of responding to personal questions in settings where these behaviors could be displayed naturally within the course of the everyday life. Finally, as in all single-subject research designs, a certain limitation could be considered for this study with respect to its external validity. This study was limited to three children with autism and the skills that are taught to these students.

In light of the findings obtained in the study and the limitations, the following recommendations could be made for further research. The effectiveness and efficiency of SP and CTD could be compared within certain teaching formats such as embedded teaching, where responding to personal questions could be taught in everyday life conditions, natural settings, and natural contexts. Similar studies comparing the effectiveness and efficiency of SP and CTD in teaching discrete and chained skills to the individuals with autism could be repeated. SP and CTD could be compared in further studies, in terms of the efficiency parameters excluding those studied in this research. Social validity data were collected only from the parents of the children with autism who participated in the study. In order to identify the preferences of trainers with respect to SP and CTD in teaching varied skills, social validity data could be collected.

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